

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: K. Matyjaszewski et al.)

Examiner: William K. Cheung

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Title: CATALYTIC PROCESSES FOR THE CONTROLLED POLYMERIZATION OF FREE
RADICALLY (CO)POLYMERIZABLE MONOMERS AND FUNCTIONAL
POLYMERIC SYSTEMS PREPARED THEREBY

APPEAL BRIEF OF APPLICANTS K. MATYJASZEWSKI ET AL.

Pittsburgh, Pennsylvania 15222
April 16, 2010

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The owner of the entire interest in the above-referenced patent application (the "Subject Application") submits this appeal in accordance with the provisions of 37 C.F.R. §41.37 in response to the Final Office Action mailed April 22, 2009 ("the Office Action"). The Office Action was issued in response to Applicant's Amendment and Response filed on February 11, 2009 ("the Amendment and Response"). Applicant filed a Notice of Appeal on October 19, 2009. The Subject Application is ripe for appeal, there being a pending final rejection in the matter. The Commissioner is hereby authorized to charge PTO Deposit Account No. 11-1110 for any fees necessary for consideration of this brief and appeal, including the fees for the requisite extension of time under 37 C.F.R. §1.136.

CERTIFICATE OF SERVICE

This appeal brief is being filed electronically using the Patent Office's EFS-WEB filing system on the date indicated above.

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I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Carnegie Mellon University, by reason of assignment of the Subject Application and the invention from the inventors recorded at Reel 010697, Frame 0967 on June 9, 2000.

II. RELATED APPEALS AND INTERFERENCES

Appellant is not aware of any other appeals or any interferences that may be related to, may directly affect, may be directly affected by, or may have a bearing on the decision of the Board of Patent Appeals and Interferences (the “Board”) in the present appeal.

III. STATUS OF CLAIMS

Claims 86, 87, 90-92, 94-139, 151, 152, 154-158, and 289 are pending and under consideration in the application. Claims 86, 107, 118, 151, and 289 are independent. Claims 140-150, 159-162, 224-227, and 270 are withdrawn from consideration. Claims 1-85, 88, 89, 93, 153, 163-223, 228-269, and 271-288 are canceled.

In paragraph 4 of the Office Action, claims 130 and 131 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In paragraph 7 of the Office Action, claims 86-87, 90-92, 94-139, and 289 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No 5,945,491 to Matyjaszewski et al. or U.S. Patent No. 6,111,022 to Matyjaszewski et al. In paragraph 6 (second occurrence, page 10) of the Office Action, claims 151, 152, and 154-158 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,945,491 to Matyjaszewski et al. in view of Patten et al., "Atom Transfer Radical Polymerization and the Synthesis of Polymeric Materials", *Advanced Materials*, **1998**, 10(12), 901-915.

Appellant appeals the rejection of claims 86, 87, 90-92, 94-139, 151, 152, 154-158, and 289.

IV. STATUS OF AMENDMENTS

All amendments previously submitted in the Subject Application have been entered. No amendments were submitted in the Subject Application subsequent to the Final Office Action.

V. SUMMARY OF CLAIMED SUBJECT MATTER

All references herein to the Specification of the Subject Application refer to the page and line numbers of the Specification as originally filed. The claims under consideration in the present appeal include claims 86, 87, 90-92, 94-139, 151, 152, 154-158, and 289. The independent claims include claims 86, 107, 118, 151, and 289.

Claim 86 describe a new process for the synthesis of macromonomers having functionality that can be used in subsequent polymerization processes. According to this process, a first oligomer or polymer from an atom transfer radical polymerization is reacted with an unsaturated second compound (or coupling compound in claim 118) having a first desired functional group (which can be an α,α -disubstituted olefin group having α -substituent groups), wherein the second compound is added to the oligomer or polymer via an atom transfer process to form a second oligomer or polymer having the first desired functional group and the radically transferable atom or group, where the second oligomer or polymer is not reactive to the catalyst. The second oligomer or polymer is not reactive to the catalyst because the functional group or α -substituent groups on the second compound do not activate the second oligomer or polymer to further ATRP polymerization. Since the second oligomer or polymer having the radically transferable atom or group cannot undergo subsequent ATRP chain elongation, the polymerization is stopped. Further, as described in claims 90, 107, and 118, the second oligomer or polymer having the radically transferable atom or group can undergo an elimination reaction, losing the radically transferable atom or group and a β -hydrogen to form a reactive unsaturated group. The resulting oligomer or polymer with a reactive unsaturated group may function as a macromonomer. See, Subject Application at page 6, lines 8-22; page 23, line 16 to page 24, line 27; Figure 6; page 28, line 31 to page 29, line 6; and Examples 14, 15.

Claim 107 describes a process for a catalytic atom transfer functionalization of oligo/polymeric materials having one or more radically transferable atom(s) or group(s), comprising the steps adding a compound containing one or more α,α -disubstituted olefin group and having α -substituent groups to a polymer having a radically transferable atom or group in

the presence of a transition metal complex capable of undergoing a redox reaction with the radically transferable atom or group, which results in the addition of the compound containing the α,α -disubstituted olefin group at the site of the radically transferable atom or group to form a second polymer and the transfer of the radically transferable atom or group back to the second polymer. The α -substituent groups of the compound containing the α,α -disubstituted olefin group are selected so that the second polymer having the radically transferable atom or group is not reactive with the transition metal complex to undergo further ATRP polymerization, and, instead, results in an elimination reaction involving the radically transferable atom or group to form a reactive unsaturated group. See, page 8, lines 17-31; page 23, line 16 to page 25, line 25; Figures 6 and 7; and Examples 14, and 15.

Claim 118 describes a process for a catalytic atom transfer coupling of polymers comprising adding a coupling compound containing one or more α,α -disubstituted olefin group(s) and having α -substituent groups to a first polymer having a first radically transferable atom or group, in the presence of a transition metal complex capable of undergoing a redox reaction with the first radically transferable atom or group. The addition of the coupling compound containing the α,α -disubstituted olefin group at the site of the first radically transferable atom or group forms an extended first polymer, and the radically transferable atom or group is transferred back to the extended first polymer. The α -substituent groups of the coupling compound are selected so that the extended first polymer having the radically transferable atom or group is not reactive with the transition metal complex to undergo further ATRP polymerization, and, instead, results in an elimination reaction wherein the radically transferable atom or group forms a reactive double bond. A second polymer having a second radically transferable atom or group in the presence of the transition metal complex is allowed to add to the reactive double bond formed from the elimination process. See, page 9, lines 1-24; page 23, line 16 to page 25, line 25; Figures 6 and 7; and Examples 14, and 15.

Claim 151 describes a controlled polymerization process wherein a core forming compound is added to an active atom transfer radical polymerization process; and polymer chains having a radically transferable atom or group are reacted with the core forming compound

to form a multi-arm star copolymer. The core forming compound is a divinyl compound. See, page 35, line 1 to page 39, line 6 including Scheme 5; and Examples 31 and 33.

Claim 289 discloses a controlled polymerization process for the production of telefunctional multi-arm star copolymers. The process includes polymerizing a free radically (co)polymerizable monomer in the presence of a system in which a second compound comprising a first desired functional group is added to the reactive chain end of a telefunctional multi-arm star initiator comprising radically transferable atoms or groups synthesized from free radically copolymerizable monomers. See, page 38, lines 3-20, including Scheme 7 and Examples 29, 30, and 32.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Whether recitation of the word “about” in claims 130 and 131 renders those claims indefinite under 35 U.S.C. §112, second paragraph.
2. Whether claims 86, 87, 90-92, 94-139, and 289 are anticipated by U.S. Patent Nos. 5,945,491 (the ‘491 patent) or 6,111,022 (the ‘022 patent) to Matyjaszewski et al. (collectively, “the Matyjaszewski patents”) under 35 U.S.C. §102(e).
3. Whether claims 151-152 and 154-158 are unpatentable under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 5,945,491 (the ‘491 patent) in view of Patten et al., “Atom Transfer Radical Polymerization and the Synthesis of Polymeric Materials,” *Adv. Mat.*, **1998**, 10(12), 901-915 (“Patten”).

VII. ARGUMENT

A. Claims 130 and 131 are not indefinite under 35 U.S.C. § 112, second paragraph.

The Examiner stated in the Office Action, with respect to claims 130 and 131, “the recitations ‘about’ fail to set the metes and bound of the claims. One of ordinary skill in [the] art would not be able to understand to avoid the infringement of the claimed invention.” Appellant respectfully submits that the claims are clear and unambiguous.

1. The standards for analyzing anticipation under 35 U.S.C. § 112, second paragraph.

Section 112, second paragraph, states that the specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter that the applicant regards as his invention. 35 U.S.C. §112. However, the fact that claim language, including terms of degree, may not be precise, does not automatically render the claim indefinite under 35 U.S.C. §112, second paragraph. MPEP § 2173.05(b) (case citation omitted). When a term of degree is presented in a claim, first a determination is to be made as to whether the specification provides some standard for measuring that degree. *Id.* If it does not, a determination is made as to whether one of ordinary skill in the art, in view of the prior art and the status of the art, would be nevertheless reasonably apprised of the scope of the invention. *Id.*

The use of the term “about” avoids a strict numerical boundary to the specified parameter. *Ortho-McNeil Pharm., Inc. v. Caraco Pharm. Labs., Ltd.*, 476 F.3d 1321, 1326, 81 USPQ2d 1427, 1432 (Fed. Cir. 1995). Its range must be interpreted in its technological and stylistic context. *Id.* In determining the range encompassed by the term “about”, one must consider the context of the term as it is used in the specification and claims of the application. MPEP § 2173.05(b) (case citation omitted).

Similar to the term "about", the term "essentially" is also definite under §112, second paragraph, when its usage is such that a person of ordinary skill in the art would understand what is claimed in light of the specification. See MPEP §§ 2173.05(b) and 2173.05(b)(B). For example, the phrase "a silicon dioxide source that is essentially free of alkali metal" was held definite because the specification contained guidelines and examples that were considered sufficient to enable a person of ordinary skill in the art to draw a line between unavoidable impurities in starting materials and essential ingredients. MPEP § 2173.05(b)(B) (citing *In re Marosi*, 710 F.2d 799, 218 USPQ 289 (CCPA 1983)). The court further observed that it would be impractical to require applicants to specify a particular number as a cutoff between their invention and the prior art, as applicants invention does not reside in such a number. See *Id.* and *In re Marosi*, 710 F.2d 799, 218 USPQ 289 (CCPA 1983).

Claims 130 & 131

Claims 130 and 131 depend on claim 128, which itself depends on claim 118. Claim 118 recites a process for a catalytic atom transfer coupling of polymers. The process generally comprises reactions among substituents of a first polymer having a first radically transferable atom or group, a coupling compound containing one or more α,α -disubstituted olefin groups, a transition metal complex, and a second polymer having a second radically transferable atom or group.

Claim 128 limits claim 118 by reciting "wherein a molar ratio of the total moles of the first polymer and the second polymer to the moles of the coupling compound is controlled to form a third polymer of a configuration of at least one of linear, star, graft, and chain extended materials containing a residue of the first polymer and the second polymer."

Claims 130 and 131 further limit claims 118 and 128 by specifying the number of α,α -disubstituted olefin units in the coupling compound, the number of radically transferable atoms or groups on each of the polymers and the molar ratios that are controlled in claim 128 to achieve the recited third polymer.

130. The process of claim 128, wherein the coupling compound contains one α,α -disubstituted olefin group, the first polymer and

second polymer have one radically transferable atom or group and a molar ratio of the total moles of the first polymer and the second polymer to the moles of the coupling compound is about 1:0.5.

131. The process of claim 128, wherein the coupling compound contains two α,α -disubstituted olefin groups, the first polymer and second polymer each have one radically transferable atom or group and the molar ratio of the total moles of the first polymer and the second polymer to the moles coupling compound is about 1:0.25

The Examiner stated in the Office Action, with respect to claims 130 and 131, that “the recitations ‘about’ fail to set the metes and bound of the claims. One of ordinary skill in [the] art would not be able to understand to avoid the infringement of the claimed invention.” Appellant respectfully submits that the claims are clear and unambiguous.

As stated above, MPEP § 2173.05(b) directs that when a term of degree is presented in a claim, it is first determined whether the specification provides some standard for measuring that degree. The specification states that the functionality that is ultimately present on a telechelic polymer and the topology formed by addition of an α,α -disubstituted olefin to an active ATRP process initiated by an initiator containing one radically transferable atom or group is dependent on, among other recited factors, the molar ratio of the α,α -disubstituted olefin that is added to the reaction and whether the molecule containing the α,α -disubstituted olefin comprises one or more α,α -disubstituted olefin units. See Subject Application at page 23, line 30 to page 24, line 6. Examples and descriptions of the third polymer configuration formed with various polymers and coupling compounds at the molar ratios recited in claims 130 and 131 are provided throughout the disclosure. See, e.g., Subject Application at page 24, line 28 to page 25, line 27 and page 32, line 30 to page 33, line 17.

As originally filed, and as stated in the Brief Summary of the Invention, (see, the Subject Application at page 9, lines 10-22), original claims 130 and 131 recited molar ratios modified by the term “essentially”. Applicant amended claims 130 and 131 during prosecution after the use of “essentially” was rejected to as indefinite. The use of “about” in amended claims 130 and 131 attempts to conform the claim language to an accepted standard of “about” in claims relating to chemical quantification when exact precision is not possible, required, or capable of encompassing the claimed subject matter.

As stated above, MPEP § 2173.05(b) directs that if the term of degree is not provided with a standard for measuring the degree in the specification, a determination is made as to whether one of ordinary skill in the art, in view of the prior art and the status of the art, would be nevertheless reasonably apprised of the scope of the invention. Appellant respectfully submits that one of ordinary skill in the art would understand the invention and be able to avoid infringement.

In particular, the use of “about” in claims reciting molar ratios in chemical reactions is standard practice as the term “about” captures the inherent impossibility of measuring reactants with exact precision. Consequently, one of ordinary skill in the art would know that achieving an exact molar ratio is not only impossible, but also not required. Thus, minor deviations in the claimed ratios would necessarily still achieve the benefits recited in the application. In addition to the above, claims 130 and 131 modify the recited ratios using the term “about”, thus, providing further notice that the subject matter encompasses more than exact molar ratios.

Accordingly, Appellant respectfully submits that one of ordinary skill in the art would understand the invention and be able to avoid infringement. Therefore, claims 130 and 131 are not indefinite under 35 U.S.C. §112, second paragraph.

B. Claims 86, 87, 90-92, 94-139, and 289 are not anticipated by the Matyjaszewski patents under 35 U.S.C. § 102(e).

The Examiner has rejected claims 86, 87, 90-92, 94-139, and 289 under 35 U.S.C. §102(e) as allegedly being anticipated by the Matyjaszewski patents¹. For the reasons that follow, Appellant respectfully submits that each of these claims is novel and patentably distinct from the Matyjaszewski patents.

1. The standards for analyzing anticipation under 35 U.S.C. § 102.

¹ The ‘491 patent and the ‘022 patent have the same specification. The ‘022 patent is a division of U.S. Serial No. 08/940,985 which issued as the ‘419 patent. References to the specification of the Matyjaszewski patents will refer only to column and line number of the ‘491 patent for brevity.

A claim is anticipated only if each and every feature as set forth in the claim is described, either expressly or inherently, in a single prior art reference, arranged as required by the claim, and in as complete detail as is contained in the claim. MPEP § 2131 (case law citations omitted). The identical invention must be described with a level of detail that is as full and complete as is recited in the claims. *Net MoneyIn, Inc. v. Verisign, Inc.*, 545 F.3d 1359 [88 USPQ2d 1751] (Fed. Cir. 2008).

The Examiner rejected claims 86-87, 90-92, 94-139, and 289 “for the reasons adequately set forth from paragraph 7 of the Office Action of September 11, 2008.”² The Examiner stated, referring to the Matyjaszewski patents, that “Matyjaszewski et al. (abstract) disclose a process of atom transfer radical polymerization for the synthesis of novel homopolymer or block copolymer. Matyjaszewski et al. (col. 16, last line of the reaction Scheme 3; col. 17, the first and the last line of the reaction Scheme 3) clearly disclose adding a coupling compound containing one or more α,α -disubstituted olefin group(s) to the first polymer in the presence of a transition metal complex capable of undergoing a redox reaction with the first radically transferable atom or group, resulting in the addition of the coupling compound containing the α,α -disubstituted olefin group at the site of the first radically transferable atom or group and an elimination reaction comprising the radically transferable atom or group to form a reactive double bond.” In response to applicants’ arguments that the claimed process describes a new process for the synthesis of macromonomers having functionality that can be used in subsequent polymerization processes and that involves a second oligomer or polymer that is not reactive to the catalyst because the functional group and/or α -substituent groups on the second component do not activate the second oligomer or polymer to further ATRP polymerization, the Examiner stated that “[i]n view of the substantially identical composition disclosed in Matyjaszewski et al. and as claimed, the examiner has a reasonable basis that the claimed ‘second oligomer or polymer

² The September 11, 2008 office action rejected claims 86-88, 90-139 and 287 for the reasons set forth in paragraph 5 of the office action of January 11, 2008, which referenced the reasons set forth in paragraph 8 of the office action of June 28, 2007, which rejected claims 86-88, 90-139, 287, 288 under 35 U.S.C. §102(e) as being anticipated by Matyjaszewski et al. (US 5,945,491 or US 6,111,022), and stated that “[a]lthough applicants argue that Matyjaszewski et al. do not teach a second compound that is not a free radically polymerizable monomer, applicants fail to recognize that Matyjaszewski et al. (col. 22, line 34-64) disclose structure (V) that definitively broadly include the a compound that is not a free radically polymerizable monomer, such as vinyl alkyl ketone (col. 22, line 34-42, 56).”

having the first desired functional group and the radically transferable atom or group is not reactive to the catalyst' feature is inherently possessed in Matyjaszewski et al." Appellant disagrees with the Examiner's characterization of the claimed process and the unsupported belief concerning the presence of claimed features in the disclosure of the Matyjaszewski patents.

Claim 86

The Examiner discussed independent claims 86, 107 and 118 together. The Examiner did not address the subject matter of the majority of dependent claims. For purposes of this Brief, each claim will be discussed separately. A description of the Matyjaszewski patents on which the Examiner bases the rejections follows.

The Matyjaszewski patents disclose a controlled atom transfer radical polymerization ("ATRP") process to form polymers having a defined structure. The polymers are synthesized by the controlled addition of radically polymerizable monomers to the growing end of the polymer chain by a reversible redox process through which a radically transferable group transfers between the growing polymer chain (dormant stage) and the catalyst. (*See, for example*, the '491 patent at column 7, line 51 to column 8, line 28). The Matyjaszewski patents disclose a method for transforming a living carbocationic polymerization or polyesterification into a living radical polymerization. (*See, for example*, the '491 patent at column 15, line 15 to column 20, line 31). The Matyjaszewski patents also disclose the synthesis of hyperbranched polymers using AB₂ monomers having an olefin and a halide. (*See, for example*, the '491 patent at column 22, line 33 to column 24, line 25). The hyperbranched polymers are formed by sequentially adding AB₂ monomers to the growing polymer through activation of the halide group by the atom transfer process. (*See, for example*, the '491 patent at Scheme 5, column 23).

In Schemes 3(a) and 3(b), the Matyjaszewski patents describe an ATRP comprising a macroinitiator prepared by a cationic polymerization (the '491 patent at column 15-18). The radically polymerizable monomers are polymerized from the cationically prepared macroinitiator. As seen in Scheme 3(a), the first line shows the formation of a polymer by a living carbocationic polymerization process. In lines 2-4, the cationically prepared macroinitiator (from line 1) is used to prepare a block copolymer via a subsequent ATRP

reaction with a radically polymerizable monomer, such as styrene (line 2), methacrylate (line 3), and methyl methacrylate (line 4). The process of Scheme 3(b) is similar to Scheme 3(a) except the first two lines of Scheme 3(b) describe a carbocationic polymerization that results in an ATRP dual functional macroinitiator. The radically polymerizable monomers are added on both sides of the macroinitiator (prepared in lines 1 and 2) one at a time through an ATRP process to form an ABA block copolymer.

The process of the Matyjaszewski patents is different than the processes of claim 86 of the Subject Application because the claimed process requires that the second compound not be a radically polymerizable monomer (and the resulting compound from addition of the monomer is not reactive to the catalyst to further polymerization), whereas all of the monomers added in the ATRP steps in the Matyjaszewski patents' Scheme 3 are radically polymerizable monomers. In the Matyjaszewski patents', since the monomers are radically polymerizable, they undergo subsequent ATRP polymerization processes under the reaction conditions to provide a well defined polymer. In contrast, in the Subject Application, the second compound is not a radically polymerizable monomer. This means that the second compound adds to the active end of the first oligomer or polymer (after removal of the radically transferable atom or group) to form the second oligomer or polymer with the radically transferable atom or group, but the second oligomer or polymer having the radically transferable atom or group will not undergo subsequent ATRP polymerization (since the end group having the radically transferable atom or group is not reactive to the catalyst). As shown in the dependent claims, the second oligomer or polymer with the radically transferable atom or group can then be transformed to another end group, for example, by β -elimination or functionalization (*see e.g.*, claim 90). The Matyjaszewski patents do not disclose this process and indeed, such a process would stop the polymerization process that the Matyjaszewski patents describe and claim. Thus, the Matyjaszewski patents do not teach each and every element of claim 86.

In view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 86 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 87

Claim 87 depends from claim 86 and provides that the catalyst of claim 86 comprises a transition metal salt. The Examiner has never addressed the subject matter of claim 87. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 87 depends. Further, the Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 87, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 87 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 90

Claim 90 depends from claim 86 and provides that the second compound of claim 86 comprises an α,α -disubstituted olefin group and the second oligomer or polymer having the radically transferable atom or group undergoes a β -elimination reaction to form a macromonomer. In the Office Action, the Examiner acknowledged Applicants' earlier argument that claim 90, like claims 107 and 118 to be discussed below, requires an " α,α -disubstituted olefin group and the second oligomer or polymer having the radically transferable atom or group undergoes a beta-elimination reaction to form a macromer", but stated that Matyjaszewski "clearly disclose adding a coupling compound containing one or more α,α -disubstituted olefin group(s) to the first polymer in the presence of a transition metal complex capable of undergoing a redox reaction with the first radically transferable atom or group, resulting in the addition of the coupling compound containing the α,α -disubstituted olefin group at the site of the first radically transferable atom or group and an elimination reaction comprising the radically transferable atom or group to form a reactive double bond." Appellant respectfully disagrees with this interpretation, for at least the reason that no elimination reaction is described in the Matyjaszewski patents.

The subject matter of claim 90 differs from the subject matter taught by the Matyjaszewski patents in that neither of the Matyjaszewski patents disclose an elimination

reaction involving the radically transferable atom or group to form a macromonomer (with a reactive double bond). An elimination reaction is a reaction that involves elimination of a portion of the reactant compound. In this case, the elimination reaction must also form a reactive unsaturated group, such as shown in Figures 6 and 7 and described, for example, on page 24, lines 7-27 of the Subject Application, describing the elimination of HBr to form a reactive unsaturated group.

The Office references Scheme 3 of the '491 patent as showing an elimination reaction. However, Scheme 3 of the Matyjaszewski patents displays the copolymer structure from the repeated addition of methyl methacrylate monomer to a polystyrene macroinitiator resulting in a copolymer having a terminal chloro group. No elimination is shown or implied in Scheme 3 of the '491 patent. Because of the structure of this monomer (for example the adjacent ester functionality), this terminal chloro group of the resulting polymer undergoes further ATRP polymerization rather than a β -elimination reaction. Thus, Scheme 3 of the Matyjaszewski patents only shows repeated polymerization and not an elimination reaction as asserted by the Examiner. Addition of methyl methacrylate does not produce a second oligomer or polymer having a radically transferable atom or group that is not reactive to the catalyst and the second oligomer or polymer does not undergo a β -elimination reaction to form a macromonomer. In view of the differences between the subject matter of claim 90 and the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 90 under 35 U.S.C. §102(e).

Claim 91

Claim 91 depends from claim 86 and provides that the catalyst is a transition metal catalyst. Although the Examiner has never addressed claim 91 individually, the discussion with regard to claims 86, 90, 107 and 118 takes the position that the second compound or coupling compound containing one or more α,α -disubstituted olefin group(s) is added to the first polymer "in the presence of a transition metal complex". The Examiner addresses grounds for rejecting claim 91 only in the context of the rejection of claim 86 and relies on the grounds for rejection of the independent claim. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 91, and further in view of the differences between the

subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 91 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 92

Claim 92 depends from claim 91 which depends from independent claim 86. Claim 92 provides that the transition metal complex comprises a transition metal and a ligand and that the process further comprises adding additional transition metal and, optionally, additional ligand. The Examiner has never addressed the subject matter of claim 92. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 92 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 92, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 92 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 94

Claim 94 depends from claim 86 and provides that the second oligomer or polymer is reacted with a third compound. The Examiner has never addressed the subject matter of claim 94. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 94 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 94, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 94 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 95

Claim 95 depends from claim 94, which depends from independent claim 86. Claim 95 provides that the second compound comprising the first desired functional group has a structure

$\text{CH}_2=\text{CR}^1-(\text{CH}_2)_n-\text{X}$, wherein R^1 is selected from H, CH_3 or aryl, n is an integer, and X is the first desired functional group. The Examiner has never addressed the subject matter of claim 95. The Examiner has instead relied only on the grounds for rejection of independent claim 86. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 95, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 95 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 96

Claim 96 depends from claim 86 and provides that the first oligomer or polymer has a plurality of radically transferable atoms or groups. The Examiner has never addressed the subject matter of claim 96. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 96 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 96, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 96 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 97

Claim 97 depends from claim 94, which depends from independent claim 86. Claim 97 provides that the second oligomer or polymer is one of a homotelechelic-polymer or a heterotelechelic polymer. The Examiner has never addressed the subject matter of claim 97. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 97 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 97, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 97 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 98

Claim 98 depends from claim 97, which depends from claims 94 and independent claim 86. Claim 98 provides that the second desired functional group is subject to further reaction conditions to convert it into a third functional group. The Examiner has never addressed the subject matter of claim 98. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 98 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 98, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 98 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 99

Claim 99 depends from claim 98, which depends from claims 97, 94 and independent claim 86. Claim 99 provides that the third functional group comprises a double bond. The Examiner has never addressed the subject matter of claim 99. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 99 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 99, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 99 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 100

Claim 100 depends from claim 99, which depends from claims 98, 97, 94 and independent claim 86. Claim 100 provides that the further reaction conditions of claim 98 results in a dehydrohalogenation reaction. The Examiner has never addressed the subject matter of claim 100. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 100 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no

separate reasons articulated for the rejection of claim 100, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 100 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 101

Claim 101 depends from claim 100, which depends from claims 99, 98, 97, 94 and independent claim 86. Claim 101 provides that the further reaction conditions include the presence of an acid acceptor. The Examiner has never addressed the subject matter of claim 101. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 101 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 101, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 101 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 102

Claim 102 depends from claim 86 and provides that the second compound is an unsaturated molecule which is not radically (co)polymerizable in the presence of the catalyst and terminates the polymer. The Examiner has never addressed the subject matter of claim 102. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 102 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 102, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 102 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 103

Claim 103 depends from claim 102, which depends from independent claim 86. Claim 103 provides that the unsaturated molecule comprises a second functional group. The Examiner has never addressed the subject matter of claim 103. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 103 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 103, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 103 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 104

Claim 104 depends from claim 103, which depends from claims 102 and independent claim 86. Claim 104 provides that a third compound having a third functional group is added and that the third functional group reacts with the first functional group incorporated on the polymer. The Examiner has never addressed the subject matter of claim 104. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 104 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 104, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 104 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 105

Claim 105 depends from claim 102, which depends from independent claim 86. Claim 105 provides that the unsaturated molecule is at least one of α,α -disubstituted olefin or an allyl derivative. The Examiner has never addressed the subject matter of claim 105. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 105 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 105, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 105 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 106

Claim 106 depends from claim 94, which depends from independent claim 86. Claim 106 provides a list of moieties from which the second desired functional group may be selected. The Examiner has never addressed the subject matter of claim 106. The Examiner has instead relied only on the grounds for rejection of independent claim 86 from which claim 106 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 106, and further in view of the differences between the subject matter of claim 86 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 106 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claims 107 and 118

With respect to independent claims 107 and 118, the Office Action addressed them together, stating that the Matyjaszewski patents disclose:

adding a coupling compound containing one or more α,α -disubstituted olefin group(s) to the first polymer in the presence of a transition metal complex capable of undergoing a redox reaction with first radically transferable atom or group, ... and an elimination reaction comprising the radically transferable atom or group to form a reactive double bond. (See, Office Action, page 8)

The Office further states that scheme 3 in cols. 16 and 17 of the Matyjaszewski patents

clearly disclose the reactive steps (1) PSt-Cl as indicated below. Regarding the argued "elimination step", in view of the substantial identical catalyst disclosed in Matyjaszewski et al. and as claimed, the examiner has a reasonable basis that the claimed "elimination" mechanism is inherently possessed in Matyjaszewski et al. Applicants must recognize that a prior art is not required to show the reaction mechanism of a reaction that is inherently possessed by the disclosed reaction or polymerization process. (See, Office Action at page 9)

Appellant respectfully disagrees.

In the Subject Application, the second polymer having the radically transferable atom or group is not reactive with the transition metal complex and instead, undergoes the elimination reaction to form a reactive unsaturated group. Figures 6 and 7 and pages 24, 32 and 87 of the Subject Application, for example, describe the elimination of HBr to form a reactive unsaturated

group. Neither of the Matyjaszewski patents disclose either explicitly or implicitly “an elimination reaction involving the radically transferable atom or group to form a reactive unsaturated group” as set forth in claims 107 and 118. The Office Action references Scheme 3 of the ‘491 as showing an elimination reaction. However, as stated above with respect to claim 90, Scheme 3 and the specification of the Matyjaszewski patents do not disclose an elimination reaction to form a reactive double bond. Instead, Scheme 3 displays the copolymer structure from the repeated addition of methyl methacrylate monomer to a polystyrene macroinitiator resulting in a copolymer having a terminal chloro group. Because of the structure (for example the adjacent ester functionality), this terminal chloro group undergoes further ATRP polymerization rather than an elimination reaction. Indeed, the purpose of process shown in Scheme 3 of the ‘491 patent is to “synthesize a block copolymer by combining a ‘living’ carbocationic polymerization with a ‘living’ radical polymerization.” (The ‘491 patent at column 15, line 15, to column 16, line 1). In Scheme 3, the terminal chloro group acts as a radically transferable atom or group in subsequent ATRP polymerization reactions and its removal by an elimination reaction to form a reactive unsaturated group would run counter to the purpose of the Scheme and the polymerization mechanism described therein.

The process of the Matyjaszewski patents is different than the process of claim 107, and claims dependent therefrom, of the Subject Application because the processes of these claims require an elimination reaction that involves the radically transferable atom or group, whereas, the reactions described in the Matyjaszewski patents (illustrated in Scheme 3) do not include an elimination reaction to form a reactive unsaturated group on the polymer or oligomer, but instead involve subsequent polymerization by the ATRP process.

Similarly, the process of the Matyjaszewski patents is different than the process of claim 118, and the claims dependent therefrom, of the Subject Application because the processes of these claims require an elimination reaction that involves the radically transferable atom or group, whereas, the reactions described in the Matyjaszewski patents (illustrated in Scheme 3) do not include an elimination reaction to form a reactive unsaturated group on the polymer or oligomer, but instead involve subsequent polymerization by the ATRP process. Further, claim 118 also requires “adding a coupling compound containing one or more α,α -disubstituted olefin group(s) to the first polymer” and additionally requires the step of “allowing a second polymer

having a second radically transferable atom or group in the presence of the transition metal complex to add to the reactive double bond.” These elements are also not disclosed in the Matyjaszewski patents. As set forth above, the Matyjaszewski patents do not disclose “an elimination reaction ... to form a reactive double bond”. Therefore, they clearly cannot disclose subsequently “allowing a second polymer ... to add to the reactive double bond.”

In the Office Action of June 28, 2007³, the Examiner stated that structure (V) of the ‘491 patent is defined broadly to “include a compound that is not a free radically polymerizable monomer, such as a vinyl alkyl ketone.” Appellant respectfully disagrees. Structure (V) on column 22, lines 34-64 of the ‘491 patent does not disclose a structure that is not a free radically polymerizable monomer such as a vinyl alkyl ketone. Instead, structure (V) describes an “inimer” (*i.e.*, a molecule that can act both as an initiator and a monomer) that can be used to prepare a hyperbranched structure. Specifically, structure (V) contains the two key components for preparing a polymer from an AB₂ type monomer (described in column 20, line 32 to column 25, line 36 of the ‘491 patent), that is, functionality of a radically polymerizable monomer (*i.e.*, the olefin bond) and functionality of an ATRP initiator (*i.e.*, a halogen atom “-X” as defined in the “-A” group of structure (V), see column 22, lines 44-45). The spacer group, -R₂⁴-, does not affect either the ability of the first olefin to undergo a radical copolymerization nor the A group’s ability to act as an initiator for an ATRP process. Therefore, the ‘491 patent does not describe a vinyl alkyl ketone or other structure that is not a free radically polymerizable monomer.

The Examiner also states at page 10 of the Office Action that claims 107-139 as written “do not require the second compound to be not free radically polymerizable.” However, as written, the claims describe a monomer that preferentially undergoes an elimination reaction involving the radically transferable atom or group when the atom or group is donated back to the growing polymer chain in a deactivation step (*i.e.*, “resulting in the addition of the compound containing the α , α -disubstituted olefin group at the site of the radically transferable atom or group ... wherein the α -substituent groups of the compound containing the α , α -disubstituted olefin group are selected so that the second polymer having the radically transferable atom or group is not reactive with the transition metal complex, and results in an elimination reaction

³ See note 2 herein.

involving the radically transferable atom or group to form a reactive unsaturated group", (*see*, claim 107). Therefore, the focus of these claims is adding a compound that undergoes a dehydrohalogenation (elimination) reaction to form an olefin bond rather than being activated to continue the ATRP copolymerization reaction. The Matyjaszewski patents do not describe an elimination reaction involving the radically transferable atom or group to form a reactive unsaturated group and instead describe continued ATRP reactions via the radically transferable group.

In the present claims, unlike the processes described in the Matyjaszewski patents, since the second oligomer or polymer having the radically transferable atom or group cannot undergo subsequent ATRP chain elongation (*i.e.*, is not reactive with the transition metal complex), the polymerization is stopped. Further, as described in claims 90, 107, and 118, the second oligomer or polymer having the radically transferable atom or group can undergo an elimination reaction, losing the radically transferable atom or group and a β -hydrogen to form a reactive unsaturated group. The resulting oligomer or polymer with a reactive unsaturated group may function as a macromonomer. These features are not described in the Matyjaszewski patents, since all polymers in those references are activated with a radically transferable atom or group to undergo subsequent atom transfer radical polymerization.

To anticipate a claim under Section 102, the cited reference must teach each and every element of the claim (*see*, MPEP § 2131). Therefore, claims 107 and 118 cannot be anticipated by the Matyjaszewski patents. Appellant requests withdrawal of the rejection of claims 107 and 118 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 108

Claim 108 depends from claim 107 and adds that the α -substituent on the α,α -disubstituted olefin group are selected from alkyl, substituted alkyl, aryl, and substituted aryl. The Examiner has never addressed the subject matter of claim 108. The Examiner has instead relied only on the grounds for rejection of independent claim 107 from which claim 108 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 108, and further in view of the differences between the subject matter of claim

107 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 108 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claims 109 and 114

Claim 109 depends from claim 108 and adds that one of the α -substituents is a methyl group, the radically transferable atom or group is a halogen and that the process further includes forming a functional polymer having a reactive exo-double bond through a dehydrohalogenation elimination reaction. Claim 114 depends from 107 and adds similar limitations. The Examiner has never addressed the subject matter of claims 109 or 114. The Examiner has instead relied only on the grounds for rejection of independent claim 107 from which claims 109 and 114 depend. The Examiner has not established that the additional limitation(s) of the claims are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 109 or 114, and further in view of the differences between the subject matter of claim 107 and, with respect to claim 109, claim 108, the teachings of the Matyjaszewski patents, and specifically the absence of an elimination reaction in the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claims 109 and 114 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 110

Claim 110 depends from claim 108, which depends from claim 107. Claim 110 adds that the α -substituents is an aryl and that the process further includes forming a functional polymer having an endo-double bond through a dehydrohalogenation elimination reaction. The Examiner has never addressed the subject matter of claim 110. The Examiner has instead relied only on the grounds for rejection of independent claim 107 from which claim 110 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 110, and further in view of the differences between the subject matter of claims 107 and 108 and the teachings of the Matyjaszewski patents, and specifically the absence of an elimination reaction in the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 110 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claims 111 and 112

Claim 111 depends from claim 110 described above and adds that the compound comprises an α -aryl styrene. Claim 112 depends from claim 111 and provides specific compounds from which the α -aryl styrene may be selected. The Examiner has never addressed the subject matter of claims 111 or 112. The Examiner has instead relied only on the grounds for rejection of independent claim 107 from which these claims depend. The Examiner has not established that the additional limitation(s) of the dependent claims are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of either of claims 111 or 112, and further in view of the differences between the subject matter of claims 107, 108 and 110 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claims 111 and 112 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 113

Claim 113 depends from claim 107 and provides that the polymeric material is an oligomer. The Examiner has never addressed the subject matter of claim 113. The Examiner has instead relied only on the grounds for rejection of independent claim 107 from which claim 113 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 113, and further in view of the differences between the subject matter of claim 107 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 113 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 115

Claim 115 depends from claim 114, which depends from claim 107. Claim 115 adds that a macromonomer with a reactive exo-double bond is prepared. The Examiner has never addressed the subject matter of claim 115. The Examiner has instead relied only on the grounds for rejection of independent claim 107 from which claim 115 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 115, and further in view of the differences between the subject matter of claim 107 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 115 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 116

Claim 116 depends from claim 107 and provides that the elimination reaction is enhanced by addition of an acid acceptor. The Examiner has never addressed the subject matter of claim 116. The Examiner has instead relied only on the grounds for rejection of independent claim 107 from which claim 116 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 116, and further in view of the differences between the subject matter of claim 107 and the teachings of the Matyjaszewski patents, and in particular because the Matyjaszewski patents do not teach an elimination reaction and therefore do not teach how to enhance such a reaction, Appellant requests withdrawal of the rejection of claim 116 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 117

Claim 117 depends from claim 116 which depends from claim 107. Claim 117 provides a group from which the acid acceptor may be selected. The Examiner has never addressed the subject matter of claim 117. The Examiner has instead relied only on the grounds for rejection of independent claim 107 from which claim 117 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 117, and further in view of the differences between the subject matter of claims 107 and 116 and the teachings of the Matyjaszewski patents, and in particular because the Matyjaszewski patents do not teach an elimination reaction, they can not teach a choice of acid acceptors with which to enhance the elimination reaction, Appellant requests withdrawal of the rejection of claim 117 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 122

Claim 122 depends from claim 107 and provides that a functional polymer is formed that comprises an enol/ketone and that the α -substituent group comprises a hydroxyl group. The Examiner has never addressed the subject matter of claim 122. The Examiner has instead relied only on the grounds for rejection of independent claim 107 from which claim 122 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the

rejection of claim 122, and further in view of the differences between the subject matter of claim 107 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 122 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 119

Claim 119 depends from claim 118 and adds that the first and second polymers are substantially similar. The Examiner has never addressed the subject matter of claim 119. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 119 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejection of claim 119, and further in view of the differences between the subject matter of claim 118 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 119 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claims 120 and 121

Claim 120 depends from claim 119 and provides that a functional polymer having an endo-double bond is formed during the elimination reaction and that the coupling compound is an α -alkyl styrene. Claim 121 depends from claim 120 and provides that the coupling compound is an α -methyl styrene. The Examiner has never addressed the subject matter of claims 120 or 121. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claims 120 and 121 depend. The Examiner has not established that the additional limitation(s) of the dependent claims are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claims 120 and 121, and further in view of the differences between the subject matter of claim 118 and the teachings of the Matyjaszewski patents, and in particular because the Matyjaszewski patents do not teach an elimination reaction and therefore can not teach the formation of a functional polymer having an endo-double bond during the elimination reaction, Appellant requests withdrawal of the rejection of claims 120 and 121 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 123

Claim 123 depends from claim 118 and adds that the coupling compound is a third polymer comprising an isopropenyl group. The Examiner has never addressed the subject matter of claim 123. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 123 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 123, and further in view of the differences between the subject matter of claim 118 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 123 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 124

Claim 124 depends from claim 123, which depends from claim 118. Claim 124 adds that the α,α -disubstituted olefin group is a pendant functional group of the third polymer. The Examiner has never addressed the subject matter of claim 124. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 124 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 124, and further in view of the differences between the subject matter of claims 118 and 123 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 124 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 125

Claim 125 depends from claim 123, which depends from claim 118. Claim 125 adds that the extended first polymer is a graft copolymer, the first polymer being grafted to the third polymer. The Examiner has never addressed the subject matter of claim 125. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 125 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 125, and further in view of the differences between the subject matter of claims 118 and 123 and the teachings of the Matyjaszewski patents, Appellant requests

withdrawal of the rejection of claim 125 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 126

Claim 126 depends from claim 118 and provides that the first polymer is a mixture of (co)polymers. The Examiner has never addressed the subject matter of claim 126. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 126 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 126, and further in view of the differences between the subject matter of claim 118 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 126 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 127

Claim 127 depends from claim 118 and provides that the second polymer is similar in composition and molecular weight to the first polymer. The Examiner has never addressed the subject matter of claim 127. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 127 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 127, and further in view of the differences between the subject matter of claim 118 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 127 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 128

Claim 128 depends from claim 118 and provides for the control of the molar ratio of the total moles of the first and second polymers to the moles of the coupling compound to form a third polymer that contain a residue of the first and second polymers. The Examiner has never addressed the subject matter of claim 128. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 128 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the

Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 128, and further in view of the differences between the subject matter of claim 118 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 128 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 129

Claim 129 depends from claim 128 and further provides for the formation of a network copolymer containing multiple units of the first polymer. The Examiner has never addressed the subject matter of claim 129. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 129 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 129, and further in view of the differences between the subject matter of claim 118 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 129 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claims 130 and 131

Claims 130 and 131 each depend from claim 128, which depends from claim 118. Claim 130 adds that the coupling compound contains one α,α -disubstituted olefin group, the first polymer and second polymer have one radically transferable atom or group and a molar ratio of the total moles of the first polymer and the second polymer to the moles of the coupling compound is about 1:0.5. Claim 131 is similar to claim 130 but provides for two α,α -disubstituted olefin groups of different reactivities and a molar ratio of about 1:0.25. The Examiner has never addressed the subject matter of claims 130 or 131 under 35 U.S.C. §102(e); only under §112, second paragraph discussed above. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claims 130 and 131 depend. The Examiner has not established that the additional limitation(s) of the dependent claims are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claims 130 or 131, and further in view of the differences between the subject matter of claims 118 and 128 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claims 130 and 131 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 132

Claim 132 depends from claim 131 and provides for differences in the first and second polymers and for the formation of a star copolymer. Like the previous dependent claims, the Examiner has not addressed the subject matter of claim 132. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 132 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 132, and further in view of the differences between the subject matter of claims 118, 128, and 131 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 132 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 133

Claim 133 depends from claim 132 and provides for the formation of a hetero-arm star copolymer. The Examiner has not addressed the subject matter of claim 133. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 133 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 133, and further in view of the differences between the subject matter of claims 118, 128, 131, and 132 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 133 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 134

Claim 134 depends from claim 131 and provides that the two α,α -disubstituted olefin groups differ in reactivity characteristics. The Examiner has not addressed the subject matter of claim 134. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 134 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 134, and further in view of the differences between the subject matter of claims 118, 128, and 131 and the teachings of the Matyjaszewski

patents, Appellant requests withdrawal of the rejection of claim 134 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 135

Claim 135 depends from claim 128, which depends from claim 118. Claim 135 further provides that the coupling compound is a compact molecule and contains three α,α -disubstituted olefin groups and that the molar ratio is controlled to form a star copolymer with up to six arms. The Examiner has not addressed the subject matter of claim 135. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 135 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 135, and further in view of the differences between the subject matter of claims 118 and 128 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 135 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 136

Claim 136 depends from claim 118 and is similar to claim 131 but does not recite a molar ration. Claim 136 provides that the coupling compound contains two α,α -disubstituted olefin groups of different reactivities and the first polymer and second polymer each have two radically transferable atoms or groups resulting in one of an extended chain or coupled polymer with an α,α -disubstituted olefin group within the chain. The Examiner has not addressed the subject matter of claim 136. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 136 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 136, and further in view of the differences between the subject matter of claim 118 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 136 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 137

Claim 137 depends from claim 128, which depends from claim 118. Claim 137 adds that the coupling compound contains three α,α -disubstituted olefin groups and the molar ratio of the total moles of the first polymer and the second polymer to the moles coupling compound is controlled to form a star polymer with up to six arms. The Examiner has not addressed the subject matter of claim 137. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 137 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 137, and further in view of the differences between the subject matter of claims 118 and 128 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 137 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 138

Claim 138 depends from claim 128 and adds the molar ratio is 1:0.167. The Examiner has not addressed the subject matter of claim 138. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 138 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 138, and further in view of the differences between the subject matter of claims 118 and 128 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 138 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 139

Claim 139 depends from claim 118 and provides that the coupling compound comprises a third polymer. The Examiner has not addressed the subject matter of claim 139. The Examiner has instead relied only on the grounds for rejection of independent claim 118 from which claim 139 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in the Matyjaszewski patents. There being no separate reasons articulated for the rejections of claim 139, and further in view of the differences between the subject matter of claim 118 and the teachings of the Matyjaszewski patents, Appellant requests withdrawal of the rejection of claim 139 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

Claim 289

Claim 289 is an independent claim that was added in the Amendment and Response filed February 11, 2009. It recites a controlled polymerization process for the production of telefunctional multi-arm star copolymers. The process includes adding a second compound comprising a first desired functional group to the end of a telefunctional multi-arm star initiator comprising radically transferable atoms or groups. In the Office Action, which was responsive to the Amendment and Response of February 11, 2009, the Examiner rejected claim 289 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents with claims 86, 107 and 118, but did not provide any reasons for rejecting claim 289. The discussions under the §102 rejection are directed to claims 86, 107 and 118 and referenced earlier office actions. However, since claim 289 was added in the previous response, it could not have been discussed in an earlier office action.⁴

Neither of the Matyjaszewski patents teach or suggest the subject matter recited in claim 289. There being no reasons articulated for the rejections of claim 289 and in view of the lack of disclosure in the Matyjaszewski patents of the claimed subject matter, Appellant requests withdrawal of the rejection of claim 289 under 35 U.S.C. §102(e) as anticipated by the Matyjaszewski patents.

C. The Examiner has not established a *prima facie* case that claims 151-152 and 154-158 are unpatentable under 35 U.S.C. § 103(a).

1. The standards for analyzing obviousness or nonobviousness under 35 U.S.C. § 103(a).

Obviousness under 35 U.S.C. §103(a) is a question of law based on at least three underlying findings of fact:

- (1) The scope and content of the prior art;

⁴ Appellant notes that claim 289 is directed to a controlled process to produce multi-arm star copolymers and that claims 151-152 and 154-158 are directed to a process wherein a multi-arm star copolymer is formed. See Applicants Arguments concerning claim 151-152 and 154-158.

- (2) The differences between the claimed invention and the prior art; and
- (3) The level of ordinary skill in the pertinent art.

Based on these facts, the legal conclusion of whether a claim, as a whole, is obvious or non-obvious is made based on a preponderance of the evidence standard. *See Graham v. John Deere Co.*, 383 U.S. 1, 17-18 [148 USPQ 459] (1966); *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398 [82 USPQ2d 1385] (2007); *In re Oetiker*, 977 F.2d 1443 [24 USPQ2d 1443] (Fed. Cir. 1992).

To this end, the Manual of Patent Examining Procedure (MPEP) provides that the contents of a §103(a) rejection set forth in an Office Action should include:

- (1) the relevant teachings of the prior art relied upon, preferably with reference to the relevant column or page number(s) and line number(s) where appropriate;
- (2) the difference or differences in the claim over the applied reference(s);
- (3) the proposed modification of the applied reference(s) necessary to arrive at the claimed subject matter; and
- (4) an explanation as to why the claimed invention would have been obvious to one of ordinary skill in the art at the time the claimed invention was made.

MPEP § 706.02(j) (Eighth Edition, Revision 7, July 2008).

As part of the determination of the scope and content of the prior art, prior art references must be considered in their entirety, *i.e.*, as a whole, including portions that would lead away from the claimed invention. MPEP § 2141.02(VI) (case law citations omitted). As part of the determination of the differences between the claims and the prior art, all of the words and features recited in the claims must be considered in judging the patentability of the claim against the prior art. MPEP § 2143.03 (case law citations omitted). Indeed, in determining the

differences between the prior art and the claims, the question under § 103(a) is whether the claimed invention as a whole would have been obvious. MPEP § 2141.02.I (case law citations omitted). It is the invention as a whole, and not some part of it, which is evaluated for obviousness under § 103. MPEP § 2141.02.V (case law citations omitted).

Accordingly, a determination regarding the obviousness or non-obviousness of the claims in a patent application involves a direct comparison of the subject matter of the claims, as a whole, to the teachings of the cited references, as a whole. A *prima facie* case of obviousness requires that the claims would have been obvious to a person skilled in the art at the time of the invention despite the differences between the claims and the teachings of the cited references. Thus, rejections on obviousness grounds cannot be sustained with mere conclusory statements or unsupported assertions. The Examiner must clearly communicate logical reasoning with rational underpinnings based on a preponderance of factual evidence to support the legal conclusion of obviousness. See MPEP § 2141; *KSR*, 550 U.S. at 418; *In re Oetiker*, 977 F.2d at 1446.

2. The asserted rejections under 35 U.S.C. § 103(a).

Claims 151-152 and 154-158 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of the '491 patent and Patten. Appellant respectfully submits that the Examiner has failed to properly establish a *prima facie* case of obviousness under 35 U.S.C. § 103(a) and the controlling case law. In the present matter, there are very significant differences and substantial distinctions between (i) the controlled polymerization processes recited in claims 151-152 and 154-158 of the Subject Application and (ii) the subject matter disclosed in the '491 patent and the Patten article. These differences and distinctions create a very large gap between the prior art and the claimed invention that is "so great as to render the [present claims] nonobvious to one reasonably skilled in the art." MPEP 2141.III (*quoting, Dann v. Johnston*, 425 U.S. 219, 230 [189 USPQ 257, 261] (1976)).

The Examiner argued that the claimed process differs from the '491 patent as lacking a core forming compound or multi-armed star copolymers. The Examiner stated that Patten discloses a core forming compound and that multi-armed star copolymers can be prepared by ATRP. However, the compound described in the Patten hyperbranched polymer synthesis is an

AB₂ type monomer and not a divinyl core forming compound as claimed. (See, Patten, Scheme 6, page 913). Neither the 491 patent nor Patten disclose or suggest adding a divinyl core forming compound to an active atom transfer radical polymerization process to form a multi-arm star copolymer via an arm-first approach as required by claim 151 and claims dependent therefrom. Appellant submits that the Examiner has not established a *prima facie* case of obviousness.

Claim 151

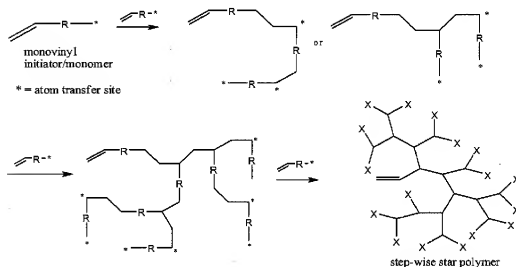
Claim 151 of the Subject Application describes an “arm-first” approach to the synthesis of a multi-arm star copolymer (*i.e.*, reacting polymer chains having a radically transferable atom or group with the core forming compound); whereas the cited references, at best, disclose a step-wise ATRP approach to star copolymers using an AB₂-type monomer. Neither the ‘491 patent nor the Patten reference teach or disclose an “arm-first” synthesis of a multi-arm star copolymer by reacting polymer chains having a radically transferable atom or group with a divinyl core forming compound. Claim 152 depends from claim 151 and claims 154-158 each depend from claim 152.

As set forth in Applicant’s Response dated September 28, 2007, claims 151-152 and 154-158 of the Subject Application describe an “arm-first” approach to the synthesis of a multi-arm star copolymer. Even though the cited references may disclose using ATRP technology to form star copolymers, claims 151-152 and 154-158 describe a different ATRP process to make the star copolymers (*i.e.*, the arm-first approach). Neither of the cited references discloses an arm-first approach to the formation of star copolymers and thus the claims are novel and non-obvious over the references.

The Examiner asserted that the claims as written do not support the argued differences between the “arm-first” approach and the “step-wise” approach. Appellant has earlier amended claim 151 to more clearly indicate that the process involves “reacting polymer chains having a radically transferable atom or group with the core forming compound to form the multi-arm star copolymer” (emphasis added) as required by the arm-first approach. Neither the ‘491 patent nor Patten disclose, teach or suggest this step. Indeed, the initiators described by the ‘491 patent and Patten all include radically transferable atoms or groups (*see* column 10, line 45 to column 11, line 53) which *cannot* react with polymer chains having a radically transferable atom or group.

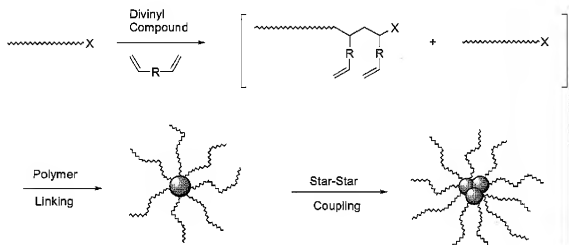
The ATRP processes disclosed in the '491 patent and/or Patten involve chain growth polymerization from an initiator (*i.e.*, step-wise growing the arms – monomer by monomer – from the initiator comprising a monovinyl group and a radically transferable atom or group). For example, see the '491 patent (column 23) reproduced below (Prior Art “Step-Wise Approach”) or Scheme 6 of Patten (page 913), which clearly illustrate forming a hyperbranched polymer via step-wise arm growth. The initiator of these references cannot undergo an arm-first growth process to form a star copolymer since it lacks two or more vinyl groups.

Prior Art “Step-Wise” Approach



The “arm-first” approach is schematically represented in Scheme 5 (page 36 of the Subject Application as filed) which illustrates the formation of a multi-arm star copolymer wherein polymers having a radically transferable atom or group (“X” in Scheme 5) react with the core forming compound to form the multi-arm star copolymer. Neither the '491 patent nor Patten disclose or suggest the step of “reacting polymer chains having a radically transferable atom or group with the core forming compound to form a multi-arm star copolymer”. Further, neither reference discloses a system comprising a divinyl compound (both references use an AB₂-type monovinyl initiator). Therefore, the cited references do not teach or suggest each and every element of the rejected claims.

Arm-First Approach (Scheme 5, page 36 of Subject Application)



The star polymers formed by these different processes will have different structures and characteristics. For example, the star polymer formed by step-wise addition of monomer units results in a star polymer with atom transferable units (*i.e.*, X) at the terminus of each arm at the periphery of the polymer, whereas the arm termini of the arm-first approach can have different functionality (or no functionality) (*see*, page 36, line 15 to page 39, line 6 of the Subject Application). Also, because the polymer “arms” have been pre-formed, the claimed arm-first process allows greater control over the functionality on the arm terminus, the molecular weight of each arm, and the molecular weight distribution of each arm. The prior art approaches do not possess this control element, nor are these elements obviously controllable using the step-wise approach. Further, the arm-first process of the Subject Application has the advantage of having transferable atoms within the core of the molecule which can be used for the polymerization of a second set of arms using a different monomer to prepare a mikto-arm type star polymer (*see* page 37, line 28 to page 38, line 2 of Subject Application). The arms of the mikto-arm type star polymer will have different phycities and allow dispersion in solvents of different polarity. In addition, the presence of a transferable atom within the core of the molecule may be used to initiate star-star coupling as seen in Scheme 5, page 36. Star polymers formed by a step-wise approach will have none of these features.

All hyperbranched polymer forming ATRP processes disclosed in the prior art references involve step-wise chain growth formation of the polymer arms by addition of the monomer units

to the initiator or the end of the growing polymer arms. There is no disclosure or suggestion in the '491 patent or Patten of forming the star copolymer topology by reacting the formed polymer arms with a core forming divinyl compound. Further, the star polymers formed from the arm-first approach will have a different structure and greater uniformity.

In the Office Action, the Examiner countered Applicants' arguments that the cited references do not disclose an "arm-first" approach to a multi-arm star copolymer by citing the addition of ethylenically unsaturated compounds to a polymer chain as shown in Scheme 3 of the '491 patent (columns 15-16). The Examiner states that the ethylenically unsaturated compounds can be considered core forming compounds. Appellant notes that these compounds are not divinyl core forming compounds as required by the claims. Therefore, this approach cannot support *prima facie* obviousness, let alone result in an arm-first star copolymer as claimed.

One having ordinary skill in the art would not be motivated by the disclosure of the '491 patent or Patten to form a multi-arm star copolymer by an "arm-first" process comprising "reacting polymer chains having a radically transferable atom or group with a core forming compound". Therefore, *prima facie* obviousness has not been established and the cited references cannot render obvious the processes of claim 151 and the claims dependent from claim 151. Withdrawal of the rejection of claim 151 and the claims that depend therefrom under 35 U.S.C. §103(a) is requested.

Claim 152

Claim 152 depends from claim 151 and adds the step of adding a plurality of initiators. The Examiner has not addressed the subject matter of claim 152. The Examiner has instead relied only on the grounds for rejection of independent claim 151 from which claim 152 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in or obvious in view of the '491 patent or Patten. There being no separate reasons articulated for the rejection of claim 152, and further in view of the differences between the subject matter of claim 151 and the teachings of the '491 patent and the Patten reference, Appellant requests withdrawal of the rejection of claim 152 under 35 U.S.C. §103(a) as being unpatentable over the combination of the '491 patent and the Patten reference.

Claim 154

Claim 154 depends from claim 152, which depends from claim 151 and defines the multi-arm star polymer as including a single well defined core. The Examiner has not addressed the subject matter of claim 154. The Examiner has instead relied only on the grounds for rejection of independent claim 151 from which claim 154 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in or obvious in view of the '491 patent or Patten. There being no separate reasons articulated for the rejection of claim 154, and further in view of the differences between the subject matter of claims 151 and 152 and the teachings of the '491 patent and the Patten reference, Appellant requests withdrawal of the rejection of claim 154 under 35 U.S.C. §103(a) as being unpatentable over the combination of the '491 patent and the Patten reference.

Claim 155

Claim 155 depends from claim 152, which depends from claim 151 and defines the multi-arm star polymer as including a core having core compound to core compound coupling. The Examiner has not addressed the subject matter of claim 155. The Examiner has instead relied only on the grounds for rejection of independent claim 151 from which claim 155 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in or obvious in view of the '491 patent or Patten. There being no separate reasons articulated for the rejection of claim 155, and further in view of the differences between the subject matter of claims 151 and 152 and the teachings of the '491 patent and the Patten reference, Appellant requests withdrawal of the rejection of claim 155 under 35 U.S.C. §103(a) as being unpatentable over the combination of the '491 patent and the Patten reference.

Claim 156

Claim 156 depends from claim 152, which depends from claim 151 and defines the multi-arm star polymer as including a network of coupled core compounds. The Examiner has not addressed the subject matter of claim 156. The Examiner has instead relied only on the grounds for rejection of independent claim 151 from which claim 156 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in or obvious in view of the '491 patent or Patten. There being no separate reasons articulated for the rejection of claim 156, and further in view of the differences between the subject matter of claims 151 and 152 and the teachings of the '491 patent and the Patten reference, Appellant

requests withdrawal of the rejection of claim 156 under 35 U.S.C. §103(a) as being unpatentable over the combination of the '491 patent and the Patten reference.

Claim 157

Claim 157 depends from claim 152, which depends from claim 151 and defines the multi-arm star polymer as being one of a gel or crosslinked system. The Examiner has not addressed the subject matter of claim 157. The Examiner has instead relied only on the grounds for rejection of independent claim 151 from which claim 157 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in or obvious in view of the '491 patent or Patten. There being no separate reasons articulated for the rejection of claim 157, and further in view of the differences between the subject matter of claims 151 and 152 and the teachings of the '491 patent and the Patten reference, Appellant requests withdrawal of the rejection of claim 157 under 35 U.S.C. §103(a) as being unpatentable over the combination of the '491 patent and the Patten reference.

Claim 158

Claim 158 depends from claim 152, which depends from claim 151 and further defines the divinyl compound. The Examiner has not addressed the subject matter of claim 158. The Examiner has instead relied only on the grounds for rejection of independent claim 151 from which claim 158 depends. The Examiner has not established that the additional limitation(s) of the dependent claim are described in or obvious in view of the '491 patent or Patten. There being no separate reasons articulated for the rejection of claim 158, and further in view of the differences between the subject matter of claims 151 and 152 and the teachings of the '491 patent and the Patten reference, Appellant requests withdrawal of the rejection of claim 158 under 35 U.S.C. §103(a) as being unpatentable over the combination of the '491 patent and the Patten reference.

VIII. CLAIMS APPENDIX

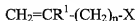
86. A process for atom transfer radical addition for adding functionality to an oligomer or polymer, comprising:

reacting a first oligomer or polymer having a radically transferable atom or group with an unsaturated second compound having a first desired functional group, the second compound reactive with the first oligomer or polymer after removal of the radically transferable atom or group, in the presence of a system comprising:

a catalyst which participates in a reversible cycle with the first oligomer or polymer transferring the radically transferable atom or group from the first oligomer or polymer to the catalyst, forming an active species from the first oligomer or polymer that adds the unsaturated second compound to form a second oligomer or polymer and transferring the radically transferable atom or group from the catalyst to the second oligomer or polymer,

wherein the second oligomer or polymer having the first desired functional group and the radically transferable atom or group is not reactive to the catalyst.

87. The process of claim 86, wherein the catalyst comprises a transition metal salt.
90. The process of claim 86, wherein the second compound comprises a α,α -disubstituted olefin group and the second oligomer or polymer having the radically transferable atom or group undergoes a β -elimination reaction to form a macromonomer.
91. The process of claim 86, wherein the catalyst is a transition metal complex.
92. The process of claim 91, wherein the transition metal complex comprises a transition metal and a ligand, and the process further comprises adding additional transition metal and, optionally, additional ligand.
94. The process of claim 86, further comprising reacting the second oligomer or polymer with a third compound which is reactive with the second oligomer or polymer, wherein the third compound has a second desired functional group.
95. The process of claim 94, wherein the second compound comprising the first desired functional group has a structure:



wherein R¹ is on selected from H, CH₃ or aryl;

n is an integer; and,

X is the first desired functional group.

96. The process of claim 86, wherein the first oligomer or polymer has a plurality of radically transferable atoms or groups.
97. The process of claim 94, wherein the second oligomer or polymer is one of a homotelechelic-polymer or a heterotelechelic polymer.
98. The process of claim 97, wherein the second desired functional group is subject to further reaction conditions to convert the second functional group into a third functional group.
99. The process of claim 98, wherein the third functional group comprises a double bond.
100. The process of claim 99, wherein the further reaction conditions results in a dehydrohalogenation reaction.
101. The process of claim 100, wherein the further reaction conditions includes the presence of an acid acceptor.
102. The process of claim 86, wherein the second compound is an unsaturated molecule which is not radically (co)polymerizable in the presence of the catalyst and terminates the polymer.
103. The process of claim 102, wherein the unsaturated molecule comprises a second functional group.
104. The process of claim 103, further comprising:
 - adding a third compound comprising a third functional group, the third compound which reacts with the first functional group incorporated on the polymer.
105. The process of claim 102, wherein the unsaturated molecule is at least one of α ,-disubstituted olefin or an allyl derivative.
106. The process of claim 94, wherein the second desired functional group comprises one of an allyl, epoxy, hydroxy, amino, cyano, carboxy, masked carboxy, alkyl, perhaloalky, silyl, silicon containing moiety or phosphorous containing moiety.
107. A process for a catalytic atom transfer functionalization of oligo/polymeric materials having one or more radically transferable atom(s) or group(s), comprising the steps:
 - providing a polymer having a radically transferable atom or group; and

- adding a compound containing one or more α,α -disubstituted olefin group and having α -substituent groups to the polymer in the presence of a transition metal complex capable of undergoing a redox reaction with the radically transferable atom or group, resulting in the addition of the compound containing the α,α -disubstituted olefin group at the site of the radically transferable atom or group to form a second polymer, transfer of the radically transferable atom or group back to the second polymer, wherein the α -substituent groups of the compound containing the α,α -disubstituted olefin group are selected so that the second polymer having the radically transferable atom or group is not reactive with the transition metal complex, and results in an elimination reaction involving the radically transferable atom or group to form a reactive unsaturated group.
108. The process of claim 107, wherein the α -substituent groups on the α,α -disubstituted olefin group are individually selected from alkyl, substituted alkyl, aryl, and substituted aryl.
109. The process of claim 108, wherein one of the α -substituent groups is a methyl group and the radically transferable atom or group is a halogen, the process further comprising:
forming a functional polymer having a reactive exo-double bond through a dehydrohalogenation elimination reaction.
110. The process of claim 108, wherein one of the α -substituent groups is an aryl group and the radically transferable atom or group is a halogen, the process further comprising:
forming a functional polymer having an endo-double bond through a dehydrohalogenation elimination reaction.
111. The process of claim 110, wherein the coupling compound comprises an α -aryl styrene.
112. The process of claim 111, wherein the α -aryl styrene is selected from diphenylethylene, 1,3-bis(1-phenylethenyl)benzene, or 2,2-bis(4-(1-phenylethenyl)phenyl)propane.
113. The process of claim 107, wherein the polymeric material is an oligimer.
114. The process of claim 107, wherein one α -substituent groups on the α,α -disubstituted olefin is a methyl group and the formed double bond is predominately an exo-double bond.
115. The process of claim 114, wherein a macromonomer with a reactive exo-double bond is prepared.
116. The process of claim 107, wherein the elimination reaction is enhanced by the addition of an acid acceptor.

117. The process of claim 116, wherein the acid acceptor is selected from the group consisting of basic organic molecules, linear and heterocyclic N containing compounds, ion exchange resins or inorganic acid acceptors.
118. A process for a catalytic atom transfer coupling of polymers comprising:
- providing a first polymer having a first radically transferable atom or group;
 - adding a coupling compound containing one or more α,α -disubstituted olefin group(s) and having α -substituent groups to the first polymer in the presence of a transition metal complex capable of undergoing a redox reaction with the first radically transferable atom or group, resulting in the addition of the coupling compound containing the α,α -disubstituted olefin group at the site of the first radically transferable atom or group to form an extended first polymer, transfer of the radically transferable atom or group back to the extended first polymer, wherein the α -substituent groups of the coupling compound are selected so that the extended first polymer having the radically transferable atom or group is not reactive with the transition metal complex, and results in an elimination reaction comprising the radically transferable atom or group to form a reactive double bond; and
 - allowing a second polymer having a second radically transferable atom or group in the presence of the transition metal complex to add to the reactive double bond.
119. The process of claim 118, wherein the first polymer and the second polymer are substantially similar.
120. The process of claim 119, further comprising:
- forming a functional polymer having an endo-double bond during the elimination reaction and wherein the coupling compound comprises an α -alkyl styrene.
121. The process of claim 120, wherein the coupling compound comprises α -methyl styrene.
122. The process of claim 107, further comprising:
- forming a functional polymer comprising an enol/ketone and wherein an α -substituent group comprises a hydroxyl group.
123. The process of claim 118, wherein the coupling compound is a third polymer comprising an isopropenyl group.
124. The process of claim 123, wherein the α,α -disubstituted olefin group is a pendant functional group of the third polymer.

125. The process of claim 123, wherein the extended first polymer is a graft copolymer comprising the first polymer grafted to the third polymer within the graft copolymer chain.
126. The process of claim 118, wherein the first polymer is a mixture of (co)polymers.
127. The process of claim 118, wherein the second polymer has a similar composition and molecular weight to the first polymer.
128. The process of claim 118, wherein a molar ratio of the total moles of the first polymer and the second polymer to the moles of the coupling compound is controlled to form a third polymer of a configuration of at least one of linear, star, graft, and chain extended materials containing a residue of the first polymer and the second polymer.
129. The process of claim 128, wherein the first polymer includes two transferable atoms or groups and the coupling compound contains two α,α -disubstituted olefin groups allowing the formation of a network copolymer containing multiple units of the first polymer.
130. The process of claim 128, wherein the coupling compound contains one α,α -disubstituted olefin group, the first polymer and second polymer have one radically transferable atom or group and a molar ratio of the total moles of the first polymer and the second polymer to the moles of the coupling compound is about 1:0.5.
131. The process of claim 128, wherein the coupling compound contains two α,α -disubstituted olefin groups, the first polymer and second polymer each have one radically transferable atom or group and the molar ratio of the total moles of the first polymer and the second polymer to the moles coupling compound is about 1:0.25.
132. The process of claim 131, wherein the first polymer and the second polymer differ in at least one of molecular weight and composition and a star copolymer is formed.
133. The process of claim 132, wherein a hetero-arm star copolymer is formed.
134. The process of claim 131, wherein the two α,α -disubstituted olefin groups differ in reactivity characteristics.
135. The process of claim 128, wherein the coupling compound is a compact molecule and contains three α,α -disubstituted olefin groups and wherein the molar ratio is controlled to form a star copolymer with up to six arms.
136. The process of claim 118, wherein the coupling compound contains two α,α -disubstituted olefin groups of different reactivities and the first polymer and second polymer each have

- two radically transferable atoms or groups resulting in one of an extended chain or coupled polymer with an α,α -disubstituted olefin group within the chain.
137. The process of claim 128, wherein the coupling compound contains three α,α -disubstituted olefin groups and the molar ratio of the total moles of the first polymer and the second polymer to the moles coupling compound is controlled to form a star polymer with up to six arms.
138. The process according to 128, wherein the molar ration is 1:0.167.
139. The process of claim 118, wherein the coupling compound comprises a third polymer.
151. A controlled polymerization process, comprising:
- adding a core forming compound to an active atom transfer radical polymerization process; and
 - reacting polymer chains having a radically transferable atom or group with the core forming compound to form a multi-arm star copolymer, wherein the core forming compound is a divinyl compound.
152. The process of claim 151, further comprising:
- adding a plurality of initiators, wherein each initiator includes:
 - a radically transferable atom or group; and
 - optionally, a functional group.
154. The process of claim 152, wherein the multi-arm star polymer includes a single well defined core.
155. The process of claim 152, wherein the multi-arm star polymer includes a core having core compound to core compound coupling.
156. The process of claim 152, wherein the multi-arm star polymer includes a network of coupled core compounds.
157. The process of claim 152, wherein the multi-arm star polymer is a one of a gel or crosslinked system.
158. The process of claim 152, wherein the divinyl compound is one of a divinyl aryl compound, a di-acrylate or a di-methacrylate.
289. A controlled polymerization process for the production of telefunctional multi-arm star copolymers, comprising:

polymerizing a free radically (co)polymerizable monomer in the presence of a system comprising:

a telefunctional multi-armed star initiator comprising radically transferable atoms or groups synthesized from free radically copolymerizable monomers, and adding a second compound comprising a first desired functional group, wherein the functional groups is incorporated into the polymer at each reactive chain end.

IX. EVIDENCE APPENDIX

None.

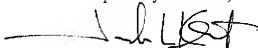
X. RELATED PROCEEDINGS APPENDIX

None.

XI. CONCLUSION

For the reasons discussed above, Appellant respectfully submits that the Examiner should be directed to: (1) withdraw the rejections under 35 U.S.C. §112, second paragraph in the Office Action; (2) withdraw the anticipation rejections under 35 U.S.C. §102(e) in the Office Action; (3) withdraw the obviousness rejections under 35 U.S.C. §103(a) in the Office Action; and (4) allow the claims pending in the Subject Application.

Respectfully submitted,



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